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Title: Optimization of Fenton process using response surface methodology and analytic hierarchy process for landfill leachate treatment

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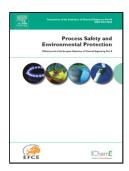
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1	Optimization of Fenton process using response surface methodology and analytic hierarchy process
2	for landfill leachate treatment
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9	Abstract
10	Typically, to treat landfill leachate, biological techniques alone are not sufficient. In this study, Fenton
11	process was found to be effective as a pretreatment method. Analytic hierarchy process (AHP) was used
12	to select the favorable catalyst between \mbox{FeSO}_4 and \mbox{FeCl}_2 when three criteria, namely, (i) COD removal,
13	(ii) sludge to iron ratio, and (iii) risk were considered. Meanwhile, response surface methodology was
14	applied to model and optimize three target responses, (i) COD removal, (ii) sludge to iron ratio, and (iii)
15	organic removal to sludge ratio. The effective variables included pH, $[H_2O_2]/[Fe^{2+}]$, Fe^{2+} dosage and
16	reaction time. In addition, to minimize the danger, generated sludge was reused in the Fenton process.
17	According to AHP sensitivity analysis results, priority percentage for $FeCl_2$ and $FeSO_4$ were 64% and
18	36%, respectively. Additionally, according to the statistical analysis, all suggested models were adequate
19	(with R^2 of 0.9171 to 0.9617). The optimum condition was found to be pH=6,
20	$[H_2O_2]/[Fe^{2+}]=20$ mole ratio, $[Fe^{2+}]=170$ mM, and reaction time=105 min. Results showed that
21	$[H_2O_2]/[Fe^{2^+}]$ and $[Fe^{2^+}]$ are significant for COD removal while pH and $[H_2O_2]/[Fe^{2^+}]$ were important
22	factors for sludge to iron ratio (SIR) and organic removal to sludge ratio (ORSR), respectively.
23	Meanwhile, when iron sludge was reused as catalyst, the results were acceptable even after five times
24	regeneration.
25	Keywords: Leachate treatment, Fenton process, Response surface methodology, Analytic hierarchy
26	process, Iron sludge reuse.
27	
28	1. Introduction
29	Sanitary landfill as an economical method for disposal of municipal solid waste (MSW) has been
30	practiced for decades all around the world. The most significant trouble in these landfills is the
31	uncontrolled release of leachate and hence contamination of ground and surface water streams (Amiri and
32	Sabour, 2014). Leachate is an aqueous liquid stream resulted from waste landfill site due to percolation of
33	rainwater through the waste, inherent moisture, and biochemical reactions occurring within the landfill
34	(Oulego et al., 2015). Several factors influence the quality and quantity of leachates such as elapsed time,

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